



University of
Zurich^{UZH}

Zurich Open Repository and
Archive

University of Zurich
University Library
Strickhofstrasse 39
CH-8057 Zurich
www.zora.uzh.ch

Year: 2020

Uniportal VATS for pectus excavatum: the Southern Switzerland experience

Cafarotti, S ; Memoli, E ; Patella, M ; Rugel, G ; Minerva, E M ; Mendoza, C M ; Tessitore, A ; Hamitaga, F

Abstract: **OBJECTIVE:** The Nuss procedure is a minimally invasive approach used to treat the pectus excavatum. One to three curved metal bars are inserted behind the sternum in order to push it into a normal position. A bilateral thoracoscopy, with 3 or 4 incisions on each side, has been reported as a safe method to repair the chest. The aim of this observational cohort study is to evaluate the safety and efficacy of the modified uniportal thoracoscopic Nuss procedure. **PATIENTS AND METHODS:** A retrospective review on 248 consecutive patients treated in Southern Switzerland in the last 5 years for chest deformity was performed. Conservative treatment with vacuum bell or dynamic compression was performed in 235 cases. Thirteen patients with pectus excavatum were surgically treated with a modified single-incision thoracoscopic approach and introduction of a single retrosternal Nuss Bar. Demographics, clinical characteristics, surgical data and results were analyzed and discussed. **RESULTS:** The male/female ratio was 11/2, with mean age of 20.75 (± 5.05) years. The Haller index was 3.65 ± 0.5 . The operative duration was 68. 2 ± 13.3 min and hospitalization stay ranged from 2 to 10 days. There was no instance of intraoperative cardiac perforation or macrovascular injury. No pleural effusion or infection was reported. The overall complication rate after a postoperative follow-up of 24.6 ± 3 months was 7.6%, without mortality, major bleeding, infectious complications, displacement or recurrence. Patients satisfaction and postoperative pain were also analyzed. **CONCLUSIONS:** The modified single-incision thoracoscopic Nuss procedure is both safe and effective for pectus excavatum correction with non-recurrence after two years.

DOI: https://doi.org/10.26355/eurrev_202009_22843

Posted at the Zurich Open Repository and Archive, University of Zurich

ZORA URL: <https://doi.org/10.5167/uzh-193581>

Journal Article

Published Version



The following work is licensed under a Creative Commons: Attribution-NonCommercial-NoDerivatives 4.0 International (CC BY-NC-ND 4.0) License.

Originally published at:

Cafarotti, S; Memoli, E; Patella, M; Rugel, G; Minerva, E M; Mendoza, C M; Tessitore, A; Hamitaga, F (2020). Uniportal VATS for pectus excavatum: the Southern Switzerland experience. *European Review for Medical and Pharmacological Sciences*, 24(17):9008-9011.

DOI: https://doi.org/10.26355/eurrev_202009_22843

Uniportal VATS for pectus excavatum: the Southern Switzerland experience

S. CAFAROTTI¹, E. MEMOLI², M. PATELLA¹, G. RUGEL¹, E.M. MINERVA¹,
C.M. MENDOZA², A. TESSITORE¹, F. HAMITAGA²

¹Thoracic Surgery Department, Ente Ospedaliero Cantonale, Università della Svizzera Italiana, Bellinzona, Switzerland

²Pediatric Surgery Department, Ente Ospedaliero Cantonale, Università della Svizzera Italiana, Bellinzona, Switzerland

Abstract. – OBJECTIVE: The Nuss procedure is a minimally invasive approach used to treat the pectus excavatum. One to three curved metal bars are inserted behind the sternum in order to push it into a normal position. A bilateral thoracoscopy, with 3 or 4 incisions on each side, has been reported as a safe method to repair the chest. The aim of this observational cohort study is to evaluate the safety and efficacy of the modified uniportal thoracoscopic Nuss procedure.

PATIENTS AND METHODS: A retrospective review on 248 consecutive patients treated in Southern Switzerland in the last 5 years for chest deformity was performed. Conservative treatment with vacuum belt or dynamic compression was performed in 235 cases. Thirteen patients with pectus excavatum were surgically treated with a modified single-incision thoracoscopic approach and introduction of a single retrosternal Nuss Bar. Demographics, clinical characteristics, surgical data and results were analyzed and discussed.

RESULTS: The male/female ratio was 11/2, with mean age of 20.75 (± 5.05) years. The Haller index was 3.65 ± 0.5 . The operative duration was 68.2 ± 13.3 min and hospitalization stay ranged from 2 to 10 days. There was no instance of intraoperative cardiac perforation or macrovascular injury. No pleural effusion or infection was reported. The overall complication rate after a postoperative follow-up of 24.6 ± 3 months was 7.6%, without mortality, major bleeding, infectious complications, displacement or recurrence. Patients satisfaction and postoperative pain were also analyzed.

CONCLUSIONS: The modified single-incision thoracoscopic Nuss procedure is both safe and effective for pectus excavatum correction with non-recurrence after two years.

Key Words:

Nuss procedure, Uniportal VATS, Pectus excavatum.

Introduction

Pectus excavatum is a congenital chest wall deformity and surgical correction is still considered the standard of care. In 1998, Nuss et al¹ documented a method for the correction of pectus excavatum with good results. Despite universal acceptance, the procedure has several postoperative complications (about 10%-50%), including rare life-threatening complications²⁻⁵). The risk of complications increases with patient age or with the use of more than one pectus bar^{4,5}. Several surgical technique modifications have been introduced in order to minimize the risks. The application of the thoracoscope in Nuss repair demonstrated an increased safety of the operation⁶⁻⁸. The video-assisted bilateral thoracoscopic approach – with 3 or 4 incisions – permit direct inspection and facilitate mediastinal dissection while eliminating the risk of cardiopulmonary injuries⁸. Uniportal VATS, also known as single-incision thoracoscopic surgery, has gained popularity in the past decade. Rocco et al⁹ published the first case series of uniportal VATS pulmonary wedge resection in 2004. Since then, uniportal VATS has been successfully performed for numerous indications, such as diagnostic procedures or sympathectomy, but also more complication procedures, such as anatomic resection of the lung. An observational cohort study of patients with pectus excavatum after surgical correction with a modified single incision approach was performed.

Patients and Methods

All patients who underwent the modified uniportal VATS Nuss procedure in the last 5 years were included. The primary indications

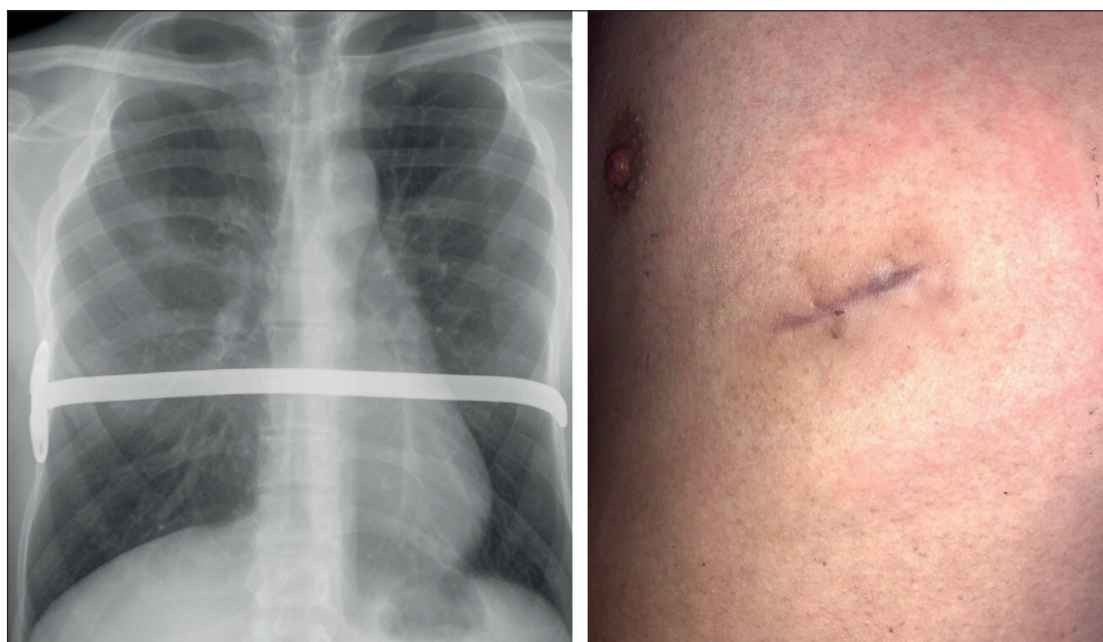


Figure 1. Bar placed and final cosmetic result.

for surgical repair were presence of one or more of the following criteria: (1) progression of the deformity; (2) exercise intolerance; (3) progressive chest pain or dyspnea; (4) restrictive ventilatory impairment; (5) $HI > 3.25$; (6) cardiac compression. According to these criteria, 13 patients (M/F 11/2) underwent a modified bilateral uniportal VATS Nuss procedure. In order to minimize the risk of cardiac and vascular injury, the bar was inserted through one single incision (2 cm) only after that a mediastinal left-to-right retrosternal tunnel was performed under direct view. A small-drainage was inserted into each pleural space using the same incisions. After extubation and after drain removal, all patients underwent postoperative radiography (Figure 1), the VAS score and satisfaction questionnaire were collected at the discharge time. Demographics, clinical characteristics, surgical data, and results were analyzed and discussed.

Results

The demographic and preoperative clinical characteristics of our patients are shown in Table I. At least one preoperative symptom was found in all patients. More than 80% of patients were male; the population had a BMI of $20.4 (\pm 2.3)$ and was older than 20 years (20.75 ± 5.05). The mean Heller Hindex was 3.65 ± 0.5 . Perioperative characteristics and overall complications are summarized in Table II. The VAS pain score at the discharge time was $1.4 (\pm 2.13)$. All patients were regularly followed up for at least 6 months postoperatively with the last follow-up at the time of removing Bar time at 24 months. The overall complication rate was 7.6%, with one case of prolonged pain.

A satisfaction questionnaire (1. not satisfied; 2. satisfied; 3. very satisfied) was administered to all patients after removing the bar, and 7.6% answered 1, while the other 92.4% answered 2 or 3.

Table I. Preoperative clinical characteristics.

Characteristic	
Mean age, years, mean \pm SD	20.75 (\pm 5.05)
Gender, male, n (%)	11 (84.6)
BMI, mean \pm SD	20.4 (\pm 2.3)
Symptoms (including chest discomfort/pain and anxiety), n (%)	13 (100)
Heller Index, mean \pm SD	3.65 (\pm 0.5)

Table II. Perioperative characteristics and overall complication.

Characteristic	
Operative time, min, mean \pm SD	68.2 (\pm 13.3)
Implanted bar(s), n (%)	13 (100)
1 more	0 (0)
Complications n (%)	1 (7.6)
Reoperation for bleeding	0 (0)
Bar infection or displacement	0 (0)
Prolonged pain	1 (7.6)
Cardiac perforation	0 (0)

Discussion

The use of bilateral thoracoscopy has been reported in both children and adults to facilitate the safe passage of the support bar between the sternum and pericardium¹⁰⁻¹³. According to some authors, blind manipulation causes fatal complications, and thoracoscopic guidance is extremely important while guiding the introducer across the anterior mediastinum^{14,15}. There are some centers that advocate routine usage of subxiphoid incision in place of thoracoscopy^{16,17}. They advocate the usage of finger guidance through a subxiphoid incision to pass the support bar under the sternum. Bilateral thoracoscopy without subxiphoid incision is the reliable method and the modified uniportal VATS procedure seems to be the normal evolution of this approach. To the best of our knowledge, just a small number of cases (less than 100) are available in the literature¹⁸⁻²⁰, and our series could be able to give a contribution for future systematic reviews and possibly to the diffusion of the technique.

Conclusions

Modified single-incision thoracoscopic Nuss procedure is both safe and effective for pectus excavatum with great the advantages in terms of shorter operative duration, mini-invasiveness, fewer complications, and excellent cosmetics and it is worthy of wider popularization.

Conflict of Interest

The Authors declare that they have no conflict of interests.

References

- 1) NUSS D, KELLY RE, CROITORU DP, KATZ ME. A 10-year review of a minimally invasive technique for correction of pectus excavatum. *J Pediatr Surg* 1998; 33: 545-552.
- 2) JAROSZEWSKI DE, EWALS MM, CHAO CJ, GOTWAY MB, LACKEY JJ, MYERS KM, MERRITT MV, SIMS SM, McMAHON LE, NOTRICA DM. Success of minimally invasive pectus excavatum procedures (modified Nuss) in adult patients (≥ 30 years). *Ann Thorac Surg* 2016; 102: 993-1003.
- 3) PILEGAARD HK. Single centre experience on short bar technique for pectus excavatum. *Ann Cardiothoracic Surg* 2016; 5: 450-455
- 4) ERŞEN E, DEMIRKAYA A, KILIÇ B, KARA HV, YAKŞI O, ALIZADE N, DEMIRHAN Ö, SAYILGAN C, TURNA A, KAYNAK K. Minimally invasive repair of pectus excavatum (MIRPE) in adults: is it a proper choice? *Wideochir Inne Tech Maloinwazyjne* 2016; 11: 98-104.
- 5) ZHANG DK, TANG JM, BEN XS, XIE L, ZHOU HY, YE X, ZHOU ZH, SHI RO, XIAO P, CHEN G. Surgical correction of 639 pectus excavatum cases via the Nuss procedure. *J Thorac Dis* 2015; 7: 1595-1605.
- 6) CHENG YL, LEE SC, HUANG TW, WU CT. Efficacy and safety of modified bilateral thoracoscopy-assisted Nuss procedure in adult patients with pectus excavatum. *Eur J Cardiothorac Surg* 2008; 34: 1057-1061.
- 7) WU TH, HUANG TW, HSU HH, LEE SC, TZAO C, CHANG H, CHENG YL. Usefulness of chest images for the assessment of pectus excavatum before and after a Nuss repair in adults. *Eur J Cardiothorac Surg* 2013; 43: 283-287.
- 8) CHENG YL, LIN CT, WANG HB, CHANG H. Pleural effusion complicating after Nuss procedure for pectus excavatum. *Ann Thorac Cardiovasc Surg* 2014; 20: 6-11.
- 9) ROCCO G, MARTIN-UCAR A, PASSERA E. Uniportal VATS wedge pulmonary resections. *Ann Thorac Surg* 2004; 77: 726-728.
- 10) SCHAARSCHMIDT K, KOLBERG-SCHWERDT A, LEMPE M, SCHLESINGER F, BUNKE K, STRAUSS J. Extrapleural, sub-muscular bars placed by bilateral thoracoscopy – a new improvement in modified Nuss funnel chest repair. *J Pediatr Surg* 2005; 40: 1407-1410.
- 11) SHAMBERGER RC. Congenital chest wall deformities. In: Grosfeld JL, O'Neill JA, Fonkalsrud EW, editors. *Pediatric Surgery*. 6th ed. St. Louis, Missouri: Mosby, 2006; pp. 894-919.
- 12) CHENG YL, LEE SC, HUANG TW, WU CT. Efficacy and safety of modified bilateral thoracoscopy-assisted

- Nuss procedure in adult patients with pectus excavatum. *Eur J Cardiothorac Surg* 2008; 34: 1057-1061.
- 13) PALMER B, YEDLIN S, KIM S. Decreased risk of complications with bilateral thoracoscopy and left-to-right mediastinal dissection during minimally invasive repair of pectus excavatum. *Eur J Pediatr Surg* 2007; 17: 81-83.
- 14) CASTELLANI C, SCHALAMON J, SAXENA AK, HÖELLWARTH ME. Early complications of the Nuss procedure for pectus excavatum: A prospective study. *Pediatr Surg Int* 2008; 24: 659-666.
- 15) OHNO K, NAKAMURA T, AZUMA T, YAMADA H, HAYASHI H, MASAHATA K. Modification of the Nuss procedure for pectus excavatum to prevent cardiac perforation. *J Pediatr Surg* 2009; 44: 2426-2430.
- 16) MILLER KA, WOODS RK, SHARP RJ, GITTES GK, WADE K, ASHCRAFT KW, SNYDER CL, ANDREWS WM, MURPHY JP, HOLCOMB GW. Minimally invasive repair of pectus excavatum: a single institution's experience. *Surgery* 2001; 130: 652-657.
- 17) ST PETER SD, SHARP SW, OSTLIE DJ, SNYDER CL, HOLCOMB GW 3RD, SHARP RJ. Use of a subxiphoid incision for pectus bar placement in the repair of pectus excavatum. *J Pediatr Surg* 2010; 45: 1361-1364.
- 18) AIZAWA T, TOGASHI S, DOMOTO T, SASAKI K, KIYOSAWA T, SEKIDO M. Modification of the Nuss procedure: the single-incision technique. *Plast Reconstr Surg Glob Open* 2014; 2: e256.
- 19) CLARK JJ, JOHNSON SM. Single incision Nuss procedure for pectus excavatum. *Pediatr Surg Int* 2011; 27: 733-736.
- 20) FURUKAWA H, SASAKI S, WILLIAM M, SEKIDO M, TSUTSUMIDA A, OYAMA A, YAMAMOTO Y. Modification of thoracoscopy in pectus excavatum: insertion of both thoracoscope and introducer through a single incision to maximise visualisation. *Scand J Plast Reconstr Surg Hand Surg* 2007; 41: 189-192.